

What is claimed is:

1    1.    A computer-implemented method of indexing a database of documents, a subset of  
2    the documents containing nested fields, each nested field having an associated start meta  
3    word and end meta word, each meta word having an associated nesting level, the method  
4    comprising:

5                indexing each document containing nested fields by:

6                        parsing the document to determine locations within the document of words  
7                                and

8                meta words in the document and to determine the nesting level associated with each meta  
9                word; and

10                generating an index including

11                        word entries, each word entry identifying locations within the  
12                                document of an identified word;

13                        meta word entries, each meta word entry identifying locations within  
14                                the document of an identified meta word and indicating the determined nesting level  
15                                associated with the meta word; and

16                        generic meta word entries, each generic meta word entry identifying  
17                                locations within the document of a class of meta words, including meta words at all nesting  
18                                levels of the meta words found in the document, the generic meta word entry including, for  
19                                each identified location within the generic meta word entry, information identifying the  
20                                nesting level associated with the meta word at the identified location.

1    2.    The computer-implemented method of claim 1, wherein each word entry, meta word  
2    entry, and generic meta word entry includes an object identifier and a location list.

1    3.    The computer-implemented method of claim 1, wherein, for each word entry, the  
2    object identifier includes one or more words, and the location list includes locations of the  
3    one or more words in the document.

1    4.    The computer-implemented method of claim 1, wherein, for each meta word entry,

2 the object identifier includes a meta word and an indication of the nesting level associated  
3 with the meta word, and the location list includes locations of the meta word in the document.

1 5. The computer-implemented method of claim 1, wherein, for each generic meta word  
2 entry, the object identifier includes a class of meta words, including meta words at all nesting  
3 levels of the meta words found in the document, and the location list includes locations of  
4 each occurrence of each meta word in the class of meta words in the document, and further  
5 includes an indication of the nesting level associated with each occurrence of each meta word  
6 in the class of meta words at each location.

1 6. The computer-implemented method of claim 5, wherein, for the location list for each  
2 generic meta word entry, each location of each occurrence of each meta word in the class of  
3 meta words in the document is mathematically combined with the nesting level associated  
4 with that occurrence of that meta word at that location to encode both the location and the  
5 nesting level into a single value.

1 7. A computer-implemented method of searching a database of documents, a subset of  
2 the documents containing nested fields, each nested field having an associated start meta  
3 word and end meta word, each meta word having an associated nesting level, the method  
4 comprising:

5 receiving a query that specifies one or more words to be found within a specified field  
6 within a document;

7 determining a start meta word and end meta word associated with the specified field;  
8 searching an index to identify locations of the specified words and locations of a class  
9 of meta words that includes at least one of the start meta word and end meta word associated  
10 with the specified field;

11 applying first spatial criteria to the identified locations of the class of meta words with  
12 respect to the identified locations of the specified words to select a meta word from the class  
13 of meta words;

14 determining the nesting level of the selected meta word;

15 identifying a complementary meta word corresponding to the selected meta word;

16                   searching the index to determine a location for the identified complementary meta  
17                   word; and

18                   applying second spatial criteria to the identified locations of the specified words and  
19                   to the determined location for the identified complementary meta word to generate a result  
20                   that indicates whether the specified words are found within a first field associated with the  
21                   selected meta word and the identified complementary meta word.

1       8.       The computer-implemented method of claim 7, wherein the first field is the specified  
2       field.

1       9.       The computer-implemented method of claim 7, wherein at least a plurality of the steps  
2       of applying first spatial criteria, determining the nesting level, identifying a complementary  
3       meta word, searching the index, and applying second spatial criteria are repeated until a final  
4       a result is generated.

1       10.      The computer-implemented method of claim 9, wherein the final result is selected  
2       from the set consisting of (A) the specified words are found within the specified field, and (B)  
3       there is no instance of the specified words within the specified field.

1       11.      The computer-implemented method of claim 7, wherein the step of identifying  
2       comprises identifying a complementary meta word corresponding to the selected meta word  
3       and to its determined nesting level.

1       12.      The computer-implemented method of claim 7, wherein the class of meta words  
2       includes a specific meta word at all nesting levels of the specific meta word found in the  
3       database.

1       13.      The computer-implemented method of claim 7, wherein the step of applying first  
2       spatial criteria comprises the steps of:  
3                   determining a closest location of the identified locations of the class of meta words  
4       with respect to an identified location of the specified words, and

5                   selecting the meta word from the class of meta words corresponding to the determined  
6                   closest location.

1       14.   The computer-implemented method of claim 13, wherein the step of applying second  
2                   spatial criteria comprises determining whether the identified location of the specified words  
3                   falls between the determined location for the identified complementary meta word and the  
4                   determined closest location of the identified locations of the class of meta words to generate a  
5                   result that indicates whether the specified words are found within the specified field.

1       15.   The computer-implemented method of claim 7, wherein the class of meta words  
2                   further includes an object identifier and a location list, the object identifier including at least  
3                   one of the start meta word and end meta word, and the location list including a location, and  
4                   nesting level information at that location, for each occurrence of the at least one of the start  
5                   meta word and end meta word.

1       16.   A computer-implemented method of searching a database of documents, a subset of  
2                   the documents containing nested fields, each nested field having an associated start meta  
3                   word and end meta word, each meta word having an associated nesting level, the method  
4                   comprising:

5                   receiving a query that specifies one or more words to be found within a first specified  
6                   field that is found within a second specified field within a document;

7                   determining a first start meta word and first end meta word associated with the first  
8                   specified field, and a second start meta word and second end meta word associated with the  
9                   second specified field;

10                  searching an index to identify:

11                  locations of the specified words,

12                  locations of a first class of meta words that includes at least one of the first  
13                  start meta word and first end meta word associated with the first specified field, and

14                  locations of a second class of meta words that includes at least one of the  
15                  second start meta word and second end meta word associated with the second specified field;

16                  applying first spatial criteria, determined at least in part from the received query, to  
17                  the identified locations of the first and second classes of meta words and the identified

18 locations of the specified words to select a first meta word from the first class of meta words,  
19 and a second meta word from the second class of meta words;  
20 determining the nesting levels of the first and second selected meta words;  
21 identifying a first and second complementary meta words, corresponding to the first  
22 and second selected meta words;  
23 searching the index to determine a location for the first identified complementary  
24 meta word and a location for the second identified complementary meta word; and  
25 applying second spatial criteria, determined from the received query, to the identified  
26 locations of the specified words and to the determined locations for the first and second  
27 identified complementary meta words to generate a result that indicates whether the specified  
28 words are found within a first field, associated with the first selected meta word and the first  
29 identified complementary meta word, that is found within a second field, associated with the  
30 second selected meta word and the second identified complementary meta word.

17. The computer-implemented method of claim 16, wherein the first field is the first  
18 specified field and the second field is the second specified field.

19. The computer-implemented method of claim 16, wherein at least a plurality of the  
20 steps of applying first spatial criteria, determining nesting levels, identifying first and second  
21 complementary meta words, searching the index, and applying second spatial criteria are  
22 repeated until a final a result is generated.

23. The computer-implemented method of claim 18, wherein the final result is selected  
24 from the set consisting of (A) the specified words are found within an instance of the first  
25 specified field that is found within an instance of the second specified field, and (B) there is  
26 no instance of the specified words within an instance of the first specified field that is within  
27 an instance of the second specified field.

28. The computer-implemented method of claim 16, wherein the steps of applying first  
29 spatial criteria, determining nesting levels, identifying first and second complementary meta  
30 words, searching the index and applying second spatial criteria include:

4 applying the first spatial criteria to the identified locations of the first class of meta  
5 words and to the identified locations of the specified words to select a first meta word from  
6 the first class of meta words;

7 determining the nesting level of the first selected meta word;

8 identifying a first complementary meta word, corresponding to the first selected meta  
9 word;

10 searching the index to determine a location for the first identified complementary  
11 meta word;

12 applying the second spatial criteria to the identified locations of the specified words  
13 and to the determined location for the first identified complementary meta word to generate a  
14 first result;

15 applying the first spatial criteria to the identified locations of the second class of meta  
16 words and to the identified location corresponding to the first selected meta word to select a  
17 second meta word from the second class of meta words;

18 determining the nesting level of the second selected meta word;

19 identifying a second complementary meta word, corresponding to the second selected  
20 meta word;

21 searching the index to determine a location for the second identified complementary  
22 meta word; and

23 applying the second spatial criteria to the determined location for the first identified  
24 complementary meta word and to the determined location for the second identified  
25 complementary meta word to generate a second result.

1 21. The computer-implemented method of claim 20, wherein at least a plurality of the  
2 steps of applying first spatial criteria to the identified locations of the first class of meta  
3 words, determining the nesting level of the first selected meta word, identifying the first  
4 complementary meta word, searching the index to determine a location for the first identified  
5 complementary meta word, and applying second spatial criteria to generate a first result are  
6 repeated until the first result is a first final result.

1 22. The computer-implemented method of claim 21, wherein the first final result is

2 selected from the set consisting of (A) the specified words are found within an instance of the  
3 first specified field, and (B) there is no instance of the specified words within an instance of  
4 the first specified field.

1 23. The computer-implemented method of claim 16, wherein the step of identifying  
2 comprises identifying a first and second complementary meta words corresponding to the first  
3 and second selected meta words, and to the determined nesting levels of the first and second  
4 selected meta words.

1 24. The computer-implemented method of claim 16, wherein the first and second classes  
2 of meta words include a specific meta word at all nesting levels of the specific meta word  
3 found in the database.

1 25. The computer-implemented method of claim 16, wherein the step of applying first  
2 spatial criteria comprises the steps of:

3 determining a closest location of the identified locations of the first class of meta  
4 words with respect to an identified location of the specified words,

5 selecting a first meta word from the first class of meta words corresponding to the  
6 determined closest location of the first class of meta words,

7 determining a closest location of the identified locations of the second class of meta  
8 words with respect to the first closest location of the identified locations of the first class of  
9 meta words, and

10 selecting a second meta word from the second class of meta words corresponding to  
11 the determined closest location of the second class of meta words.

1 26. The computer-implemented method of claim 25, wherein the step of applying second  
2 spatial criteria comprises the steps of:

3 determining whether the identified location of the specified words falls between the  
4 determined location for the first identified complementary meta word and the determined  
5 closest location of the first class of meta words,

6           determining whether the determined location for the first identified complementary  
7   meta word falls between the determined location for the second identified complementary  
8   meta word and the identified location of the specified words, and

9           generating a result, based on the determining steps of applying second spatial criteria,  
10   that indicates whether that the specified words are found within an instance of the first  
11   specified field that is found within an instance of the second specified field.

1   27.   The computer-implemented method of claim 16, wherein the first class of meta words  
2   further includes an object identifier and a location list, the object identifier including at least  
3   one of the first start meta word and first end meta word, and the location list including a  
4   location, and nesting level information at that location, for each occurrence of the at least one  
5   of the first start meta word and first end meta word.

1   28.   The computer-implemented method of claim 16, wherein the first class of meta words  
2   and the second class of meta words constitute the same class of meta words.

1   29.   A computer-implemented method for searching an index of a database of documents,  
2   the index having entries, each entry including an object identifier and a location list, each  
3   object identifier including at least one of a word and a meta word, each location list including  
4   one or more locations of the at least one of a word and a meta word of each corresponding  
5   object identifier, each entry associated with a meta word also including nesting level  
6   information for the meta word, the computer-implemented method comprising:

7           receiving a query that specifies one or more words to be found within a specified field  
8   within a document;

9           determining a start meta word and end meta word associated with the specified field;

10          identifying a bounding meta word by selecting one of the start meta word and end  
11   meta word;

12          searching the index to identify a first entry that has an object identifier associated with  
13   the specified words;

14          searching the index to identify a second entry that has an object identifier  
15   associated with the bounding meta word;

16 determining a bounding location from a closest occurrence of the bounding meta word  
17 with respect to the specified words, by comparing the location list of the second entry and the  
18 location list of the first entry;

19 identifying nesting level information for the bounding meta word at the bounding  
20 location;

21 identifying a complementary meta word to the bounding meta word having  
22 corresponding nesting level information as the identified nesting level information for the  
23 bounding meta word;

24 searching the index to locate a third entry that has an object identifier associated with  
25 the complementary meta word;

26 determining a complementary location from the location list of the third entry; and  
27 generating a result that indicates whether the specified words are within a first field,  
28 associated with the bounding meta word and the complementary meta word, by determining  
29 whether a location in the location list of the first entry falls between the bounding location  
30 and the complementary location.

30. The computer-implemented method of claim 29, wherein the complementary location  
31 of the complementary meta word is opposite to the bounding location of the bounding meta  
32 word, relative to the specified words, in the index of the database of documents.

1 31. The computer-implemented method of claim 29, wherein the first field is the specified  
2 field.

1 32. The computer-implemented method of claim 29, wherein the step of determining a  
2 bounding location comprises determining a bounding location of the bounding meta word by  
3 applying first spatial criteria to the location list of the second entry and the location list of the  
4 first entry, and further wherein the computer-implemented method includes repeating at least  
5 a plurality of the steps of determining a bounding location, identifying nesting level  
6 information, identifying a complementary meta word, searching the index, determining a  
7 complementary location, and generating a result until a final a result is generated.

1 33. The computer-implemented method of claim 32, wherein the final result is selected

2 from the set consisting of (A) the specified words are found within the specified field, and (B)  
3 there is no instance of the specified words within the specified field.

1 34. A computer program product for use in conjunction with a computer system, the  
2 computer system for indexing a database of documents, a subset of the documents containing  
3 nested fields, each nested field having an associated start meta word and end meta word, each  
4 meta word having an associated nesting level, the computer program product comprising a  
5 computer readable storage medium and a computer program mechanism embedded therein,  
6 the computer program mechanism comprising:

7 an indexer for indexing each document containing nested fields by configuring the  
8 computer to:

9 parse the document to determine locations within the document of words and  
10 meta words in the document and to determine the nesting level associated with each meta  
11 word; and

12 generate an index including

13 word entries, each word entry identifying locations within the  
14 document of an identified word;

15 meta word entries, each meta word entry identifying locations  
16 within the document of an identified meta word and indicating the determined nesting level  
17 associated with the meta word; and

18 generic meta word entries, each generic meta word entry  
19 identifying locations within the document of a class of meta words, including meta words at  
20 all nesting levels of the meta words found in the document, the generic meta word entry  
21 including, for each identified location within the generic meta word entry, information  
22 identifying the nesting level associated with the meta word at the identified location.

1 35. The computer program product of claim 34, wherein each word entry, meta word  
2 entry, and generic meta word entry includes an object identifier and a location list.

1 36. The computer program product of claim 34, wherein, for each meta word entry, the  
2 object identifier includes a meta word and an indication of the nesting level associated with  
3 the meta word, and the location list includes locations of the meta word in the document.

1 37. The computer program product of claim 34, wherein, for each generic meta word  
2 entry, the object identifier includes a class of meta words, including meta words at all nesting  
3 levels of the meta words found in the document, and the location list includes locations of  
4 each occurrence of each meta word in the class of meta words in the document, and further  
5 includes an indication of the nesting level associated with each occurrence of each meta word  
6 in the class of meta words at each location.

1 38. The computer program product of claim 37, wherein, for the location list for each  
2 generic meta word entry, each location of each occurrence of each meta word in the class of  
3 meta words in the document is mathematically combined with the nesting level associated  
4 with that occurrence of that meta word at that location to encode both the location and the  
5 nesting level into a single value.

1 39. A computer program product for use in conjunction with a computer system, the  
2 computer system for searching a database of documents, a subset of the documents containing  
3 nested fields, each nested field having an associated start meta word and end meta word, each  
4 meta word having an associated nesting level, the computer program product comprising a  
5 computer readable storage medium and a computer program mechanism embedded therein,  
6 the computer program mechanism comprising:

7       instructions for receiving a query that specifies one or more words to be found within  
8 a specified field within a document;

9       instructions for determining a start meta word and end meta word associated with the  
10 specified field;

11       instructions for searching an index to identify locations of the specified words and  
12 locations of a class of meta words that includes at least one of the start meta word and end  
13 meta word associated with the specified field;

14       instructions for applying first spatial criteria to the identified locations of the class of  
15 meta words with respect to the identified locations of the specified words to select a meta  
16 word from the class of meta words;

17       instructions for determining the nesting level of the selected meta word;

18       instructions for identifying a complementary meta word corresponding to the selected  
19   meta word;

20       instructions for searching the index to determine a location for the identified  
21   complementary meta word; and

22       instructions for applying second spatial criteria to the identified locations of the  
23   specified words and to the determined location for the identified complementary meta word  
24   to generate a result that indicates whether the specified words are found within a first field  
25   associated with the selected meta word and the identified complementary meta word.

1   40.   The computer program product of claim 39, wherein the first field is the specified  
2   field.

3       41.   The computer program product of claim 39, wherein at least a plurality of the  
4   instructions for applying first spatial criteria, determining the nesting level, identifying a  
5   complementary meta word, searching the index, and applying second spatial criteria are  
6   repeated until a final a result is generated.

7       42.   The computer program product of claim 41, wherein the final result is selected from  
8   the set consisting of (A) the specified words are found within the specified field, and (B)  
9   there is no instance of the specified words within the specified field.

1       43.   The computer program product of claim 39, wherein the instructions for identifying  
2   comprise instructions for identifying a complementary meta word corresponding to the  
3   selected meta word and to its determined nesting level.

1       44.   The computer program product of claim 39, wherein the class of meta words includes  
2   a specific meta word at all nesting levels of the specific meta word found in the database.

1       45.   The computer program product of claim 39, wherein the instructions for applying first  
2   spatial criteria comprise:

3       instructions for determining a closest location of the identified locations of the class  
4   of meta words with respect to an identified location of the specified words, and

5           instructions for selecting the meta word from the class of meta words corresponding  
6    to the determined closest location.

1    46.    The computer program product of claim 45, wherein the instructions for applying  
2    second spatial criteria comprise instructions for determining whether the identified location of  
3    the specified words falls between the determined location for the identified complementary  
4    meta word and the determined closest location of the identified locations of the class of meta  
5    words to generate a result that indicates whether the specified words are found within the  
6    specified field.

1    47.    The computer program product of claim 39, wherein the class of meta words further  
2    includes an object identifier and a location list, the object identifier including at least one of  
3    the start meta word and end meta word, and the location list including a location, and nesting  
4    level information at that location, for each occurrence of the at least one of the start meta  
5    word and end meta word.

1    48.    A computer program product for use in conjunction with a computer system, the  
2    computer system for searching a database of documents, a subset of the documents containing  
3    nested fields, each nested field having an associated start meta word and end meta word, each  
4    meta word having an associated nesting level, the computer program product comprising a  
5    computer readable storage medium and a computer program mechanism embedded therein,  
6    the computer program mechanism comprising:

7           instructions for receiving a query that specifies one or more words to be found within  
8    a first specified field that is found within a second specified field within a document;

9           instructions for determining a first start meta word and first end meta word associated  
10    with the first specified field, and a second start meta word and second end meta word  
11    associated with the second specified field;

12          instructions for searching an index to identify:

13           locations of the specified words,

14           locations of a first class of meta words that includes at least one of the first  
15    start meta word and first end meta word associated with the first specified field, and

16                   locations of a second class of meta words that includes at least one of the  
17                   second start meta word and second end meta word associated with the second specified field;  
18                   instructions for applying first spatial criteria, determined at least in part from the  
19                   received query, to the identified locations of the first and second classes of meta words and  
20                   the identified locations of the specified words to select a first meta word from the first class  
21                   of meta words, a second meta word from the second class of meta words;  
22                   instructions for determining the nesting levels of the first and second selected meta  
23                   words;  
24                   instructions for identifying a first and second complementary meta words,  
25                   corresponding to the first and second selected meta words, and searching the index to  
26                   determine a location for the first identified complementary meta word and a location for the  
27                   second identified complementary meta word; and  
28                   instructions for applying second spatial criteria, determined from the received query,  
29                   to the identified locations of the specified words and to the determined locations for the first  
30                   and second identified complementary meta words to generate a result that indicates whether  
31                   the specified words are found within a first field, associated with the first selected meta word  
32                   and the first identified complementary meta word, that is found within a second field,  
33                   associated with the second selected meta word and the second identified complementary meta  
34                   word.

1       49.    The computer program product of claim 48, wherein the first field is the first specified  
2       field and the second field is the second specified field.

1       50.    The computer program product of claim 48, wherein at least a plurality of the  
2       instructions for applying first spatial criteria, determining nesting levels, identifying first and  
3       second complementary meta words, searching the index, and applying second spatial criteria  
4       are repeated until a final a result is generated.

1       51.    The computer program product of claim 50, wherein the final result is selected from  
2       the set consisting of (A) the specified words are found within an instance of the first specified  
3       field that is found within an instance of the second specified field, and (B) there is no instance

4 of the specified words within an instance of the first specified field that is within an instance  
5 of the second specified field.

1 52. The computer program product of claim 48, wherein the instructions for applying first  
2 spatial criteria, determining nesting levels, identifying first and second complementary meta  
3 words, searching the index and applying second spatial criteria include:

4 instructions for applying the first spatial criteria to the identified locations of the first  
5 class of meta words and to the identified locations of the specified words to select a first meta  
6 word from the first class of meta words;

7 instructions for determining the nesting level of the first selected meta word;

8 instructions for identifying a first complementary meta word, corresponding to the  
9 first selected meta word;

10 instructions for searching the index to determine a location for the first identified  
11 complementary meta word;

12 instructions for applying the second spatial criteria to the identified locations of the  
13 specified words and to the determined location for the first identified complementary meta  
14 word to generate a first result;

15 instructions for applying the first spatial criteria to the identified locations of the  
16 second class of meta words and to the identified location corresponding to the first selected  
17 meta word to select a second meta word from the second class of meta words;

18 instructions for determining the nesting level of the second selected meta word;

19 instructions for identifying a second complementary meta word, corresponding to the  
20 second selected meta word;

21 instructions for searching the index to determine a location for the second identified  
22 complementary meta word; and

23 instructions for applying the second spatial criteria to the determined location for the  
24 first identified complementary meta word and to the determined location for the second  
25 identified complementary meta word to generate a second result.

1 53. The computer program product of claim 52, wherein at least a plurality of the  
2 instructions for applying first spatial criteria to the identified locations of the first class of  
3 meta words, determining the nesting level of the first selected meta word, identifying the first

4 complementary meta word, searching the index to determine a location for the first identified  
5 complementary meta word, and applying second spatial criteria to generate a first result are  
6 repeated until the first result is a first final result.

1 54. The computer program product of claim 53, wherein the first final result is selected  
2 from the set consisting of (A) the specified words are found within an instance of the first  
3 specified field, and (B) there is no instance of the specified words within an instance of the  
4 first specified field.

1 55. The computer program product of claim 48, wherein the instructions for identifying  
2 comprise instructions for identifying a first and second complementary meta words  
3 corresponding to the first and second selected meta words, and to the determined nesting  
4 levels of the first and second selected meta words.

1 56. The computer program product of claim 48, wherein the first and second classes of  
2 meta words include a specific meta word at all nesting levels of the specific meta word found  
3 in the database.

1 57. The computer program product of claim 48, wherein the instructions for applying first  
2 spatial criteria comprise:  
3       instructions for determining a closest location of the identified locations of the first  
4 class of meta words with respect to an identified location of the specified words,  
5       instructions for selecting a first meta word from the first class of meta words  
6 corresponding to the determined closest location of the first class of meta words,  
7       instructions for determining a closest location of the identified locations of the second  
8 class of meta words with respect to the first closest location of the identified locations of the  
9 first class of meta words, and  
10      instructions for selecting a second meta word from the second class of meta words  
11 corresponding to the determined closest location of the second class of meta words.

1 58. The computer program product of claim 51, wherein the instructions for applying  
2 second spatial criteria comprise:

3           instructions for determining whether the identified location of the specified words  
4   falls between the determined location for the first identified complementary meta word and  
5   the determined closest location of the first class of meta words,

6           instructions for determining whether the determined location for the first identified  
7   complementary meta word falls between the determined location for the second identified  
8   complementary meta word and the identified location of the specified words, and

9           instructions for generating a result that indicates whether that the specified words are  
10   found within an instance of the first specified field that is found within an instance of the  
11   second specified field if both determinations are true.

1       59.   The computer program product of claim 48, wherein the first class of meta words  
2   further includes an object identifier and a location list, the object identifier including at least  
3   one of the first start meta word and first end meta word, and the location list including a  
4   location, and nesting level information at that location, for each occurrence of the at least one  
5   of the first start meta word and first end meta word.

1       60.   The computer program product of claim 48, wherein the first class of meta words and  
2   the second class of meta words constitute the same class of meta words.

1       61.   A computer program product for use in conjunction with a computer system, the  
2   computer system for searching an index of a database of documents, the index having entries,  
3   each entry including an object identifier and a location list, each object identifier including at  
4   least one of a word and a meta word, each location list including one or more locations of the  
5   at least one of a word and a meta word of each corresponding object identifier, each entry  
6   associated with a meta word also including nesting level information for the meta word, the  
7   computer program product comprising a computer readable storage medium and a computer  
8   program mechanism embedded therein, the computer program mechanism comprising:

9           instructions for receiving a query that specifies one or more words to be found within  
10   a specified field within a document;

11           instructions for determining a start meta word and end meta word associated with the  
12   specified field;

13       instructions for identifying a bounding meta word by selecting one of the start meta  
14       word and end meta word;  
15       instructions for searching the index to identify a first entry that has an object identifier  
16       associated with the specified words;  
17       instructions for searching the index to identify a second entry that has an object  
18       identifier associated with the bounding meta word;  
19       instructions for determining a bounding location from a closest occurrence of the  
20       bounding meta word with respect to the specified words, by comparing the location list of the  
21       second entry and the location list of the first entry;  
22       instructions for identifying nesting level information for the bounding meta word at  
23       the bounding location;  
24       instructions for identifying a complementary meta word to the bounding meta word  
25       having corresponding nesting level information as the identified nesting level information for  
26       the bounding meta word;  
27       instructions for searching the index to locate a third entry that has an object identifier  
28       associated with the complementary meta word;  
29       instructions for determining a complementary location from the location list of the  
30       third entry; and  
31       instructions for generating a result that indicates whether the specified words are  
32       within a first field, associated with the bounding meta word and the complementary meta  
33       word, by determining whether a location in the location list of the first entry falls between the  
34       bounding location and the complementary location.

1       62.    The computer program product of claim 61, wherein the complementary location of  
2       the complementary meta word is opposite to the bounding location of the bounding meta  
3       word, relative to the specified words, in the index of the database of documents.

1       63.    The computer program product of claim 61, wherein the first field is the specified  
2       field.

1       64.    The computer program product of claim 61, wherein the instructions for determining a

2 bounding location comprise instructions for determining a bounding location of the bounding  
3 meta word by applying first spatial criteria to the location list of the second entry and the  
4 location list of the first entry, and further wherein the computer program product includes  
5 instructions for repeating at least a plurality of the instructions for determining a bounding  
6 location, identifying nesting level information, identifying a complementary meta word,  
7 searching the index, determining a complementary location, and generating a result until a  
8 final a result is generated.

1 65. The computer program product of claim 64, wherein the final result is selected from  
2 the set consisting of (A) the specified words are found within the specified field, and (B)  
3 there is no instance of the specified words within the specified field.

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